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The Distributional Effect of Indirect Taxes on Irish Households

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Abstract: We develop an indirect tax microsimulation model, using the 2022/2023 Household Budget Survey, to model how indirect taxes affect Irish households. The modelling accounts for value added tax, specific excise duties on fuel, alcohol and tobacco products, alongside the carbon tax. Our findings indicate indirect tax liabilities are regressive when assessed relative to household income, with a more neutral pattern emerging when comparison is made to household expenditure.

I INTRODUCTION

We estimate household liabilities to indirect taxes using the Expenditure, VAT and Excise (EVE) model, a static indirect tax microsimulation model using household expenditure data. The modelled Irish indirect tax system is broadly composed of non-carbon excise duties, carbon-based excise duties and a value added tax (VAT). The system is highly complex, due to significant heterogeneity in the taxation of consumption. This complexity means a model of the household sector is important to understand the incidence of the existing system, alongside ex ante analysis of the yield and incidence of marginal reforms.

From whom these revenues are raised is a core equity issue. Indirect taxes are levied on consumption and, as such, the incidence of indirect taxes across the

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income distribution is unclear a priori. A model of indirect taxes, with income and consumption data, is an important analytical tool for measuring the incidence of taxes on consumption across the household income distribution. We use detailed household level data to simulate indirect tax liabilities across households with different consumption habits. Our work is timely and provides updated estimates on the incidence of indirect taxes, which is particularly relevant given how the COVID-19 pandemic may have affected household spending patterns. It also captures the effects of rising retail energy prices, which motivated a number of temporary cost-of-living measures by the Government from 2022 to 2024 to help households deal with rising prices.

In an Irish context, this analysis complements work by a number of authors. O'Donoghue *et al*. (2004), Barrett and Wall (2006), Decoster *et al*. (2010), Collins (2014) and Savage (2017) have examined the regressivity of the indirect tax system. Madden (1995; 1995a) and Savage (2016) investigated optimal commodity taxation and optimal marginal reforms to the indirect tax system. Leahy *et al*. (2011) examined the distributional impact of VAT. A series of authors have examined the distributional implication of the carbon tax and the role of revenue recycling using household microdata (see for example Callan *et al*., 2009; Verde and Tol, 2009; Bercholz and Roantree, 2019; O'Malley *et al*., 2020; Reaños and Lynch, 2022). A series of outputs using the I3E model, a computable general equilibrium model of the Irish economy, have also examined the economic and distributional implications of carbon taxes – see for instance de Bruin and Yakut (2024). Overall, the literature using microsimulation models indicates that indirect taxes are regressive relative to household income. International evidence also suggests that consumption taxes are generally regressive with respect to cross-sectional household income, therefore placing a larger burden on low-income households (see for example Decoster *et al*., 2010; Figari and Paulus, 2015; Blasco *et al*., 2023). In contrast, when assessed relative to household expenditure, tax incidence is more compressed between low and high-expenditure households (Poterba, 1989), with recent findings by Thomas (2022) highlighting that VAT has a low degree of progressivity when measured relative to household expenditure. Comparison to household income is informative, as income is the qualifying criteria nationally and internationally for numerous large social assistance programmes. Comparison to household expenditure is also useful. From a theoretical perspective, cross-sectional expenditure should be closely linked to lifetime resources if households can borrow or dissave so as to smooth consumption (Cutler and Katz, 1992). Empirical evidence also suggests that households at the very bottom of the income distribution have expenditure levels close to median expenditure (Brewer *et al*., 2017). As such, comparison to expenditure is informative and may give a more accurate measure of living standards for low-income households, particularly those with relatively high expenditure levels. We present findings on the incidence of indirect taxes relative to both income and expenditure in order to inform a well-rounded

discussion. In a policy context, the ITSim model jointly developed by the Department of Finance and the Economic and Social Research Institute which has been used extensively for policy analysis – see for instance (Roantree *et al*., 2021; Department of Finance, 2023) – is comparable to the EVE model outlined here.

In line with the literature, we find that when one compares indirect tax liabilities to household income a regressive pattern emerges, with a more neutral pattern emerging when comparison is made to household expenditure. The lowest income decile of households pay, on average, €88.8 per week in indirect taxes – equivalent to 20.5 per cent of income or 13.8 per cent of expenditure. For households in the top income decile, these payments are larger in absolute terms, at €158.3 per week on average, but smaller in relative terms, amounting to 5.8 per cent of income or 10.8 per cent of expenditure. Our results on the incidence of indirect taxes across the income distribution are most similar to Barrett and Wall (2006), Collins (2014) and Savage *et al*. (2017), despite changes in the indirect tax system over time. Sorting households by household expenditure results in a more neutral pattern of incidence than income-based metrics alone. The lowest decile of households, on an expenditure basis, have indirect tax liabilities amounting to 15.5 per cent of expenditure on average, compared to 12.2 per cent for the highest decile of households on an expenditure basis. This spread across low and high-expenditure households is caused by excise duties being a larger share of spending among low-expenditure households. In contrast, VAT liabilities appear as relatively neutral across the expenditure distribution.

In contextualising our findings, it is important to caveat that the indirect tax system is not designed for redistribution per se. Rather, it has an important role in achieving public health goals of reducing consumption of unhealthy products, taxing environmentally damaging energy sources and revenue generation for the Exchequer. In a policy context, the role of indirect taxes as a source of revenue is topical. The Commission on Taxation and Welfare (2022) also made a number of recommendations around VAT in their report – such as limiting the use of zero and reduced rates of VAT and increasing the reduced rate of VAT from 13.5 per cent over time.[1] Casey and Carroll (2023) also highlight that climate transition in the medium term will result in a significant decrease in tax revenues on a policy-constant basis, primarily due to falling excises on mineral oils and VAT on energy-related consumption. As such, the importance of indirect taxes, and analytical tools to analyse their effect across households, will be increasingly important in the context of proposed tax reforms.

Related to the breadth of the indirect tax system, we find that indirect taxes are broad-based in Ireland, with revenues generated from households across the income distribution. Our analysis indicates that of revenues generated from the household sector, 41 per cent of revenues come from households in the bottom-half of the

[1] Recommendations 6.8 and 6.10 respectively.

income distribution, with the remaining 59 per cent coming from households in the top-half of the income distribution. On average, indirect tax liabilities amount to 12.6 per cent of household expenditure, with higher liabilities for low-income households (13.8 per cent for the lowest decile of households) and lower liabilities for high-income households (10.8 per cent for the highest decile of households). We suggest that policymakers consider reforms to indirect taxes carefully. In particular, consideration of the idealised portion of household expenditure which should be taxed is the fundamental question in this regard; based on our estimates, this was 12.6 per cent in 2023. Reforms could seek to adjust this tax take by adjusting tax rates on desired goods and services via excises, or by amending VAT rates and the categorisation of goods and services. In any case, a goal tax rate should be targeted, as this will allow policymakers to balance revenue-raising objectives with distributional concerns.

The remainder of the paper is structured as follows: Section II outlines the indirect tax system in Ireland. Section III discusses the modelling framework and validation of the EVE model. Section IV examines the incidence of indirect taxes across the income and expenditure distributions. Section V discusses the implications of our findings for policymakers. Section VI concludes.

II IRISH INDIRECT TAX SYSTEM

In this section we will discuss elements of the indirect tax system modelled in the EVE model, which is based on the parameters in place in June 2023. The focus in the EVE model is on modelling indirect taxes on household final consumption. As such, stamp duties and vehicle registration tax are not modelled and the focus is on VAT,[2] non-carbon excises and the carbon tax. Of these, VAT is the most significant tax heading. The modelling of the VAT system is complex with four positive rates of VAT alongside a zero rate of VAT applied to certain goods and services. For the household sector, the unit of analysis within the model, there are three positive VAT rates.[3] The standard rate of 23 per cent, a reduced rate of 13.5 per cent and a super-reduced rate of 9 per cent. The standard rate of 23 per cent applies to alcohol products, tobacco products, adult clothing and footwear, liquid fuels and the majority of non-food related goods. The reduced rate of 13.5 per cent applies predominantly to services such as labour involved in household maintenance services, vehicle maintenance, veterinary fees, hospitality/tourism, and footwear repair, inter alia. Energy products such as gas and electricity for commercial and domestic use also fall under the 13.5 per cent umbrella. The 9 per cent VAT rate

[2] VAT on new housing is not included in the model.

[3] The fourth positive rate of VAT is a rate of 4.8 per cent applied to a variety of livestock that is not applicable to the household sector.

applies to a minority goods and services including certain electronic books and periodicals alongside provision of facilities for taking part in sport. The 9 per cent VAT rate has been used as a recent policy tool. Gas and electricity are temporarily in the 9 per cent bracket to ease cost-of-living pressures while the hospitality and tourism sectors also availed of the 9 per cent rate since the COVID-19 pandemic until the end of August 2023. A number of goods have a zero VAT rate applied, such as most staple foods,[4] children's clothing and footwear, baby toiletries, along with over-the-counter and prescription medicines. Other goods and services are also classified as VAT exempt, with childcare fees being a relevant example. This means that no VAT is charged to consumers and VAT paid on inputs by suppliers is not recoverable. In contrast, VAT paid on inputs by suppliers would be recoverable in instances where a zero rate of VAT applied.

VAT is an important source of revenue for the Irish Exchequer. Over the period 1984 to 2022, VAT has, on average, contributed to 26.7 per cent of total tax revenues per annum. In recent periods, the role of VAT has diminished somewhat, despite marked growth in receipts post-pandemic. VAT receipts amounted to 22.4 per cent of total tax receipts in 2022, a decline from 25.5 per cent observed in 2019. Changes in the level and composition of consumption led to a decline in indirect taxes during the pandemic – see Coffey *et al*. (2020) for results based on simulation methods. This is evident in the dip in VAT receipts during 2020 as shown in Figure 2. Net VAT receipts have grown significantly in real terms post-pandemic, and in 2022 contributed €18.8 billion to the Exchequer. The relative decline in VAT has been caused by a surge in corporation tax receipts. These corporation tax receipts are highly concentrated among a small number of firms (Cronin, 2023) and are generally viewed as temporary/windfall in nature due to significant firm and industry-specific risk associated with the tax base. Non-carbon excises have also become a much less important element of the Irish tax base over the long run. These receipts comprised 23.4 per cent of all tax receipts in 1984 compared to 5.6 per cent in 2022. As shown in Figure 2, inflation-adjusted receipts from these excises have grown over time. As such, the decrease in the relative weight of non-carbon excises is mostly attributable to rapid growth in income tax and corporation tax over the same period, reflecting the changing nature of the Irish economy. Carbon taxes were introduced in the Finance Act 2010 and represent a small share of the overall tax take. The carbon tax contributed €223 million to the Exchequer in 2010, rising to €791 million in 2022 as the carbon tax rate has risen from €15 per tonne to €41 per tonne over the period.

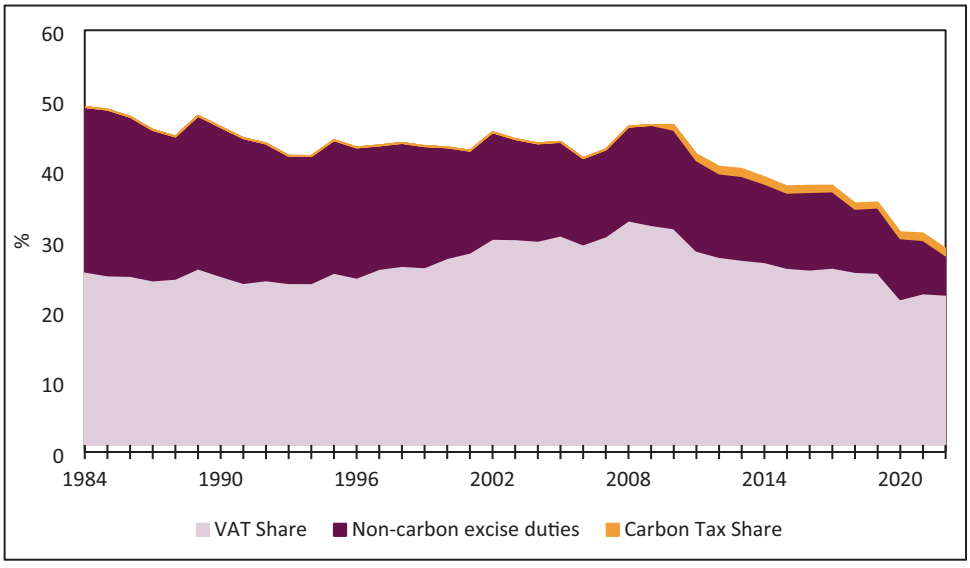
[4] There is some variance in how food from a grocery store/shop is treated for VAT purposes. Most food products fall into the staple category and are tied to the 0 per cent VAT rate. Chocolate bars, chewing gums, crisps, ice-creams and other frozen dairy products are all subject to the 23 per cent rate of VAT. Soft-drinks, energy drinks and bottled water are also all subject to the 23 per cent VAT rate.

Within EVE, we model VAT in detail and also model a set of excises. Specifically, we model:

- Mineral Oil Tax, which we apply to light oil (petrol), heavy oil (diesel) and fuel oil (home-heating oil);
- Alcohol Products Tax, which we apply to beer (>2.8 per cent ABV),[5] wine (still >5.5 per cent ABV, still >15 per cent ABV and sparkling >5.5 per cent ABV), spirits, cider and perry (>2.8 per cent and <6.6 per cent ABV);
- Tobacco Products Tax, which we apply to cigarettes, cigars and fine-cut tobacco;
- Carbon Tax, which we apply to the consumption of petrol, diesel, kerosene, liquid propane gas (LPG), solid fuels (coal and peat briquettes) and natural gas.[6]

Details on the modelled rates of excise underpinning these taxes are available in Appendix Table A.1.

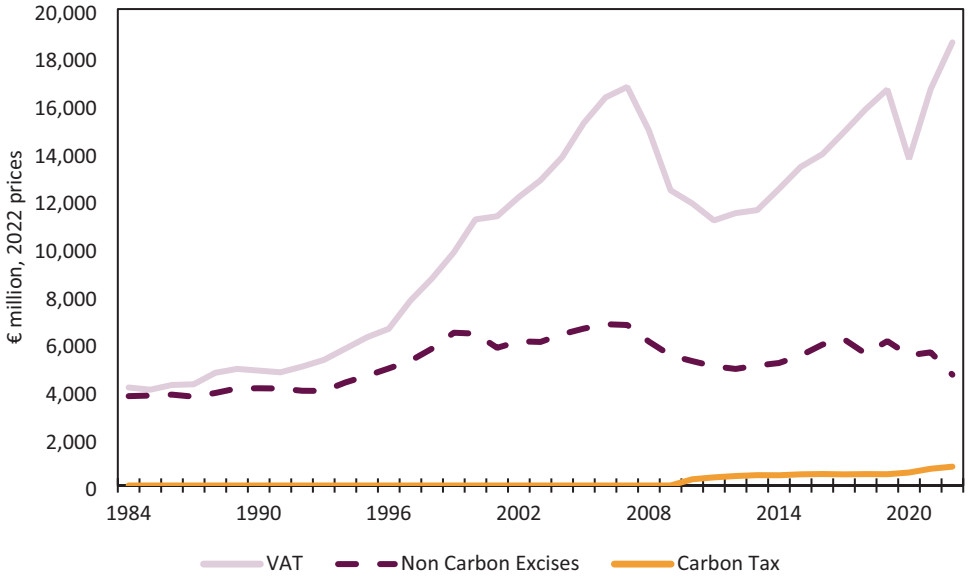
Figure 1: Selected Indirect Tax Receipts as a Share of Total Tax Receipts, 1984 to 2022



Source: Author's analysis using data from the Department of Finance DataBank and the Revenue Commissioners.

[5] ABV denotes alcohol by volume and is the millilitres of pure ethanol present in a 100 millilitre solution.
[6] We model the carbon component of the Mineral Oil Tax within the Carbon Tax routine for consistency.

Figure 2: Selected Indirect Tax Receipts (€ million) 1984 to 2022, in 2022 Constant Prices



Source: Author's analysis using data from the Department of Finance DataBank and the Revenue Commissioners.

III METHODOLOGY

We use the Household Budget Survey (HBS) 2022/2023 Research Microdata File (Central Statistics Office, 2024) as the baseline dataset for the model. At the time of writing, this was the latest available household expenditure dataset available. The HBS contains detailed expenditure data compiled from 1,737 households. Surveyed households complete a detailed expenditure diary over a two-week period.[7] A processing team in the Central Statistics Office (CSO) then scans diary and receipt items included in the diaries into a data processing system. Each item is then assigned a Classification of Individual Consumption According to Purpose (COICOP) code. The final expenditure data made available to researchers are detailed, with over 400[8] expenditure items across a range of goods and services. The achieved sample size – 1,737 households – in the 2022/2023 HBS is significantly lower than the sample size in past instances of the survey with 6,389

[7] The format of the diary, from past iterations of the survey, is available at: https://www.cso.ie/en/media/csoie/releasespublications/documents/ep/householdbudgetsurvey/2015-2016/appendices/HBS_Diary_2015-2016_for_web.pdf.

[8] 234 food items; 20 in alcohol/tobacco; 16 in clothing and footwear; 5 in fuel and light; 15 in housing; 11 in household non-durables; 29 in household durables; 29 in transport; and 91 in miscellaneous goods and services.

households participating in the 2015/2016 HBS. The CSO has acknowledged difficulties in recruiting households to participate in the survey, with difficulties in recruiting interviewers also noted.[9] Future iterations of the HBS will be released on an annual basis, with ongoing surveying of households and additional efforts made to raise awareness.[10]

We make one statistical adjustment to the HBS 2022/2023 to adjust for the under-reporting of alcohol and tobacco consumption, which is a well-documented issue in survey data. Literature in the public health sphere has estimated that survey estimates of alcohol consumption tend to be between 40 and 60 per cent of sales data (Boniface *et al*., 2014). This has also been noted in the indirect tax microsimulation literature, with De Agostini *et al*. (2017) highlighting low coverage of excise receipts from alcohol and tobacco across a range of countries when integrating an indirect tax tool to the direct tax and benefit model EUROMOD. To adjust for the low coverage of alcohol consumption, we estimate consumption[11] of each alcohol type in the underlying survey data and match these to the corresponding consumption reported by Revenue Commissioners for 2023. We then re-scale alcohol consumption amongst households to reach 80 per cent of alcohol and tobacco consumption at baseline.[12] This broadly follows the public health literature, see World Health Organization (2019), where surveyed alcohol consumption is frequently adjusted to 80 per cent of per capita consumption from sales data. We also adjust tobacco consumption (cigarettes and other tobacco products) in the same manner.

We model three broad indirect tax headings: VAT, non-carbon excises and carbon-based excises. VAT is modelled by matching all the line items of expenditure in the data to the relevant VAT rate using the VAT rates database compiled by the Revenue Commissioners. The VAT-exclusive and VAT-inclusive expenditure are easily discriminated once this mapping is complete. We model the VAT portion of expenditure as follows:

$$VAT^{k}_{i,j} = Expenditure_{i,j} * \nu^{k}/(1 + \nu^{k}) \tag{1}$$

[9] See: Information Note on the Household Budget Survey 2022-2023 – Central Statistics Office.

[10] See: Press Statement Launch of awareness campaign for CSO's new Household Budget Survey 2024 - CSO - Central Statistics Office.

[11] Consumption here refers to the volume of the relevant alcohol consumed e.g. litres of beer etc.

[12] We assume the rate of abstinence from alcohol and tobacco is not under-reported, but rather that households who purchase alcohol (either from on-licence or off-licenced premises) or smoke, under-report their consumption. In examining the data, we calculate that 62.0 per cent of households purchased either on-licence or off-licence alcohol, while 15.3 per cent of households purchased some form of tobacco product. The Healthy Ireland Survey from 2023 (Department of Health, 2024) reported that 70 per cent of persons over 15 consume alcohol annually, with 38 per cent consuming alcohol weekly, while 18 per cent of persons over 15 smoked. As such, the smoking patterns in the model seem comparable to those reported in health surveys, while abstinence from alcohol is slightly higher. Future iterations of the EVE model may make adjustments to zero-expenditure shares in alcohol and tobacco alongside considering other factors which may affect under-reporting as outlined in Livingston and Callinan (2015).

where $VAT^k_{i,j}$ denotes the VAT liable on expenditure by household i on good/service j liable to a VAT rate k. This is determined as the product of household expenditure on good j scaled by the relevant VAT rate k, denoted as v^k. We also model a series of non-carbon excises which are liable on alcohol, tobacco products and mineral oils. As excises are based upon the quantum of a commodity consumed, we estimate quantities by dividing total expenditure by average prices for taxable commodities based upon average price data available from the CSO's PxStat. We retrieve average prices for tobacco products, alcohol products (on-licence and off-licence) and mineral oils to infer consumption levels. The excise payable by household i, on a commodity j with an excise rate of y per x units consumed can be expressed as:

$$Excise_{i,j} = \frac{Expenditure_{i,j}}{P_j} * \frac{y}{x} \tag{2}$$

where P_j is the national average price of commodity j and we assume this is representative of prices in the population. This is our only option as the data did not contain quantity or price data. This approach has been adopted in previous research such as Savage (2017).

The final elements of the indirect tax system we model are carbon-based excises or simply the carbon tax. In Irish legislation, the carbon tax has slightly different specifications for mineral oils, natural gas and solid fuels.[13] We model the carbon tax for each energy source based on the legislative specification[14] and source emission factors,[15] calorific values, fuel densities and additional average prices from the Sustainable Energy Authority of Ireland website. For mineral oils, this means that for a household i, which consumes a mineral oil m, we model their carbon tax liability, $CT_{i,m}$, as:

$$CT_{i,m} = EF_m * NCV_m * CTRate * Q_{i,M}/1000 \tag{3}$$

where EF_m represents the emission factor of m expressed in tonnes of carbon per terajoule, NCV_m represents the net calorific value of m in terajoules per 1,000 litres, $CTRate$ is the national rate of carbon tax (per tonne of carbon) and $Q_{i,M}$ is the number of litres of consumed by a household i. For natural gas, g, the carbon tax liability of household i is modelled as:

$$CT_{i,g} = EF_g * CTRate/1000 * 0.0036 * Q_{i,g} \tag{4}$$

[13] See Sections 64, 67 and 78 of the Finance Act 2010.

[14] Alternative, but symmetric approaches, involve converting all consumption to a common energy equivalent such as Tonne of Oil Equivalent and then converting to carbon.

[15] We use the following emission factors (tonnes of carbon dioxide per terajoule): petrol = 70, diesel = 73.3, kerosene = 71.4, liquid propane gas = 63.7, natural gas = 56, coal = 94.6. We apply the emission factor for coal to peat also.

where EF_g is the emission factor of natural gas in kilogrammes of carbon per terajoule, 0.0036 is the number of terajoules per megawatt hour and $Q_{i,g}$ is the estimated number of megawatt hours of natural gas consumed by a household i. Finally, carbon tax liabilities on a solid fuel, s, for a household i are modelled as:

$$CT_{i,s} = EF_s * NCV_s * CTRate * Q_{i,s}/1000 \quad (5)$$

where EF_s is the relevant emission factor in tonnes of carbon dioxide equivalent per terajoule, NCV_s is the net calorific value in terajoules per tonne of s, $CTRate$ is the national carbon tax per tonne of carbon and $Q_{i,s}$ is the estimated quantity of fuel s (in kilogrammes) consumed by household i.

In Table 1 we show validation statistics of the modelled indirect tax system. We compare the modelled baseline estimates for 2023 from the EVE model to the latest official record from the Irish Revenue Commissioners. The model performs well in terms of replicating the tax take on most alcohol products, with wine and cider/perry all close to yields from the Revenue Commissioners. There is lower coverage of beers and spirits. For beers, within the HBS a number of categories of alcohol are aggregated – beers, ales, lager and stouts. As prices and alcohol content of these may vary, it is difficult to fully match aggregate yields. For spirits, the model approximates spirit consumption by averaging across whiskey, vodka and brandy prices and alcohol content. As there is significant price variation in the spirits market, the excise content as a share of the consumer price, for a given alcohol content, will be higher for lower priced spirit products. Therefore, for a given level of expenditure on a spirit with a fixed alcohol content, the excise content of expenditure will be higher in instances where households consume lower priced spirits.[16] The modelled yield from petrol consumption, €501 million, is close to the 2023 yield of €412 million, with temporary lower rates in place on petrol and diesel through 2023 explaining the differential. Total diesel consumption is underestimated in the model, with €607 million in diesel excises modelled compared to a €1,150 million yield in 2023. Diesel consumption is high in the freight and commercial vehicle sector, with the SEAI 2023 National Energy Balance[17] indicating that just 42 per cent of diesel used for transport was consumed by private cars. Adjusting for this means that closer to €480 million of diesel excises are attributable to the household sector, comparable to the modelled result, with differences attributable to temporary differences in excises on fuels. Modelling of cigarette and tobacco receipts also compares well to the reported receipts. In terms of carbon tax, the overall size of the modelled carbon tax yield for 2023,

[16] Collins (2014) allowed alcohol prices to follow an income gradient and found the results on indirect tax incidence to be very small. As such, this discrepancy is unlikely to have a bearing on the distributional analysis in later sections.

[17] Available at: https://www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/.

€487 million, is smaller than recorded receipts of €811 million in 2023. The EVE model does not account for firm-level carbon tax liabilities, so is not expected to match outturn data. Even so, the composition of carbon tax also looks reasonable, aside from the underestimate of diesel due to the commercial and freight vehicle consumption, which drives the majority of the differential.

On VAT, the final VAT receipts amounted to €20.2 billion in 2023. However, only a portion of this VAT is attributable to final consumption of the household sector. The European Commission estimates that 53 per cent of the estimated VAT liability in 2019 is attributable to household final consumption[18] (European Commission, 2022). As shown in Table 1, when we adjust the aggregate VAT take for the share accruing to the household sector, the model can replicate the expenditure base for VAT relatively well. The model estimates a VAT yield of €8,729 million, which is comparable to the €10,706 million attributable to household final consumption in 2023. Overall, the validation highlights that the model approximates the current expenditure and indirect tax base for the household sector quite well, and is therefore a robust model.

IV DISTRIBUTIONAL IMPACT OF INDIRECT TAXES

From Table 1, we have a total yield from the modelled indirect tax system of €12.2 billion in 2023. This is a significant sum of monies financed directly from household consumption. To understand the scale of this, net Exchequer tax receipts collected amounted to €87.2 billion in 2023 (Revenue Commissioners, 2024), so our modelled indirect tax system accounts for approximately 13.9 per cent of total net Exchequer tax receipts. Clearly, an understanding of which households finance this significant portion of the tax base is important. In doing so, we can also assess whether these indirect taxes are particularly burdensome on certain households, which would raise equity concerns about the system itself. One should also note that redistribution goals are better facilitated by the direct tax and transfer system. In contrast, the indirect tax system has particularly important roles for public health via taxing cigarette and alcohol consumption, for pricing the externalities of alcohol consumption and for tackling environmental concerns via taxing fuels and carbon-rich energy sources. Barrett and Wall (2006) highlight that the scope for redistribution in the Irish indirect tax system is limited, but that policymakers should be cautious about adding to the regressivity of the system. Overall, while the goal of the indirect tax system is not to redistribute, it is important to consider which cohorts of society are most adversely affected by taxes on consumption.

[18] Government consumption, intermediate consumption of firms and gross capital formation are the remaining consumption items which constitute the notional VAT base in the authors' calculations. This share has remained similar in later VAT Gap publications, with the latest showing a rate of 53 per cent for 2022 data.

Table 1: Modelled Tax Yields and Recorded Yields, € million

	Modelled (2023)	*Outturn (2023)*
Non-carbon excises		
Beers	329	404
Wine	372	374
Cider/Perry	40	50
Spirits	366	410
Petrol	501	412
Diesel	607	1,150 *
Tobacco	123	148
Cigarettes	668	857
Carbon Tax		
Petrol	106	108
Diesel	186	447 *
Kerosene	70	105
LPG	22	25
Solid Fuels	34	19
Natural Gas	69	107
Value Added Tax		
Household Sector	8,729	10,706 **

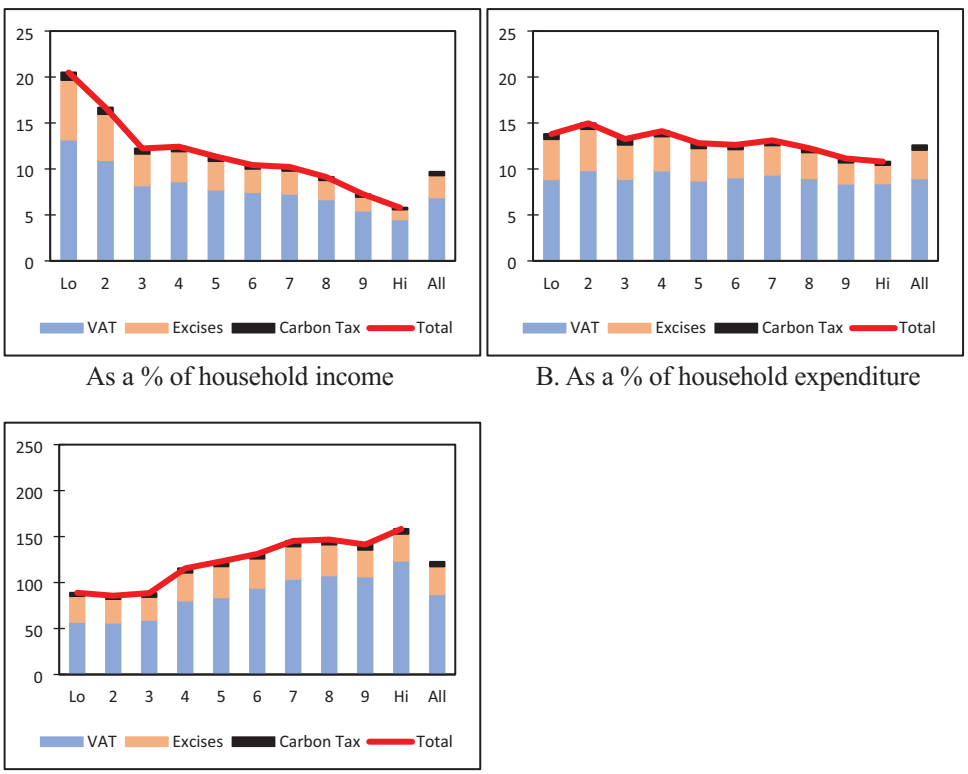
Source: Author's analysis using the EVE model and the HBS 2022/2023 and Revenue Commissioners.
Notes: Modelled results are based on the indirect tax parameters for 2023, excluding any temporary decreases to insulate households from inflationary pressures. Outturn receipts are from the Revenue Commissioners and as reported for the calendar year 2023.
*Includes large share of diesel consumption related to freight and commercial vehicles.
**Adjusted to household sector liabilities by scaling cumulative VAT by 53 per cent.

Household income is a natural metric against which to assess the distributional impact of a tax or transfer programme. When considering indirect taxes however, household expenditure is also a relevant metric. In the literature, very low-income households have been observed to have higher than expected expenditure levels when the joint income-expenditure distribution has been measured (Brewer and O'Dea, 2012; Brewer *et al*., 2017). Household expenditure may give more insights about expected lifetime resources, as cross-sectional expenditure levels will be linked to expected lifetime wealth and income based on the permanent income hypothesis. IFS *et al*. (2011), Kakoulidou and Roantree (2021) and Thomas (2022) recommend assessing the incidence of indirect taxes relative to current expenditure rather than household income. The argument in favour of this approach is that it strips away the effect of savings. Low-income households with high spending cannot dissave indefinitely, while high-income households with high savings will

have these savings taxed in future time periods as they consume their savings. Given these findings, we compare the incidence of indirect taxes relative to both cross-sectional household income and household expenditure.

In Figure 3, we sort households into income deciles and compare the incidence of indirect taxes across the income distribution. In creating deciles, household income is equivalised using the Irish national equivalence scale, which assigns a weight of 1 to the first adult in the household, a weight of 0.66 for subsequent adult-equivalents (aged 14 or older) and 0.33 for children (aged less than 14). Across all households, indirect tax liabilities amount to an average of €122.4 per week, equivalent to 9.7 per cent of income or 12.6 per cent of expenditure. Households in the lowest income decile pay an average of €88.8 per week in indirect taxes, equivalent to 20.5 per cent of their average household income or 13.8 per cent of average household expenditure. Households in the highest income decile pay an

Figure 3: Incidence of Indirect Taxes by Household Income Decile



As a % of household income

B. As a % of household expenditure

C. € per week

Source: Author's analysis using the EVE model and the HBS 2022/2023.

Notes: Households are sorted into income deciles based on equivalised disposable income using the Irish national equivalence scale. The results are also presented in tabular format in Table A.2.

average of €158.3 per week in indirect taxes, equivalent to 5.8 per cent of their average household income or 10.8 per cent of average household expenditure. As such, the profile of incidence is noticeably regressive as a share of income, but much less as a share of expenditure. This arises as households in the lowest income decile are dissavers on average, having an average expenditure-to-income ratio of 1.49, as per Figure 5. The expenditure-to-income ratio falls along the income distribution – as households tend to be savers on average – meaning that taxes on expenditure therefore appear smaller relative to income as one moves into higher income deciles.

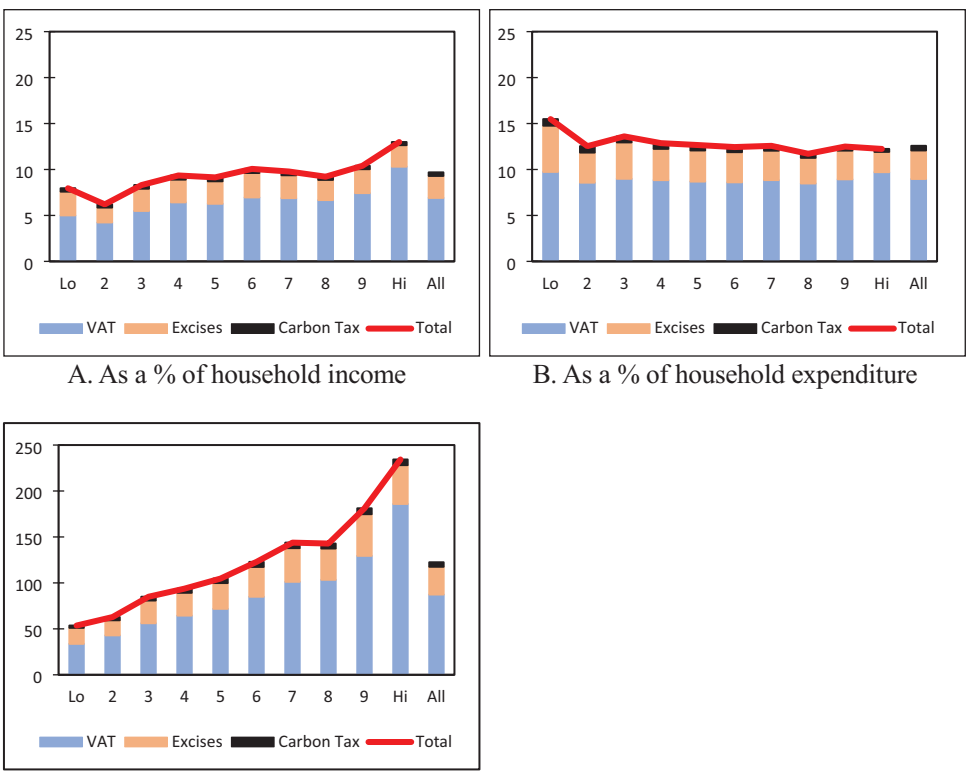
To further contrast the incidence of indirect taxes, we consider payment burdens relative to expenditure and also sort households into expenditure deciles in Figure 4. In creating expenditure deciles, household expenditure is equivalised using the Irish national equivalence scale. On this basis, indirect taxes appear less regressive – a common feature in the literature. The lowest expenditure decile have average indirect tax liabilities of €53.6 per week, equivalent to 8.0 per cent of average income or 15.5 per cent of average expenditure. The highest expenditure decile have average indirect tax liabilities of €234.3 per week, equivalent to 13.0 per cent of average income or 12.2 per cent of average expenditure. Across expenditure deciles, indirect tax liabilities are slightly regressive relative to expenditure, with liabilities ranging from 15.5 per cent of expenditure for the lowest decile, 12.7 per cent for the fifth decile and 12.2 per cent for the top decile. This spread across the expenditure distribution is attributable to low-expenditure households having relatively larger liabilities for excises on alcohol, tobacco and mineral oils, with larger relative liabilities for carbon taxes also contributing. Interestingly, VAT appears as approximately proportional across the expenditure distribution, with VAT liabilities amounting to 9.7 per cent of expenditure for both the lowest and highest expenditure deciles. This finding is in line with Thomas (2022), who highlighted that VAT tends to be significantly more progressive when compared to expenditure rather than income. Finally, indirect taxes appear as progressive across expenditure deciles when liabilities are expressed relative to average income levels. Liabilities arising from indirect taxes range from 8.0 per cent of income for the lowest expenditure decile, 9.1 per cent for the fifth decile and 13.0 per cent for the highest expenditure decile. This finding is explained by differences in savings patterns across the expenditure distribution. Low expenditure households tend to have high savings rates, with an expenditure-to-income ratio of 0.51 on average. In contrast, high expenditure households exhibit dissaving patterns, having an expenditure-to-income ratio of 1.06 on average, as shown in Figure 5. As such, this means that when indirect tax liabilities are compared to income they appear as progressive across the expenditure distribution.

In short, indirect taxes appear as regressive when expressed as a share of income across the income distribution, but a more neutral pattern emerges when assessed as a share of expenditure. Indirect taxes are slightly regressive as a share

of expenditure across the expenditure distribution but are progressive as a share of income. The broad-based nature of indirect taxation is highlighted by the incidence of indirect taxes across the income distribution – households in the bottom-half of the income distribution pay 41 per cent of modelled indirect tax receipts, while households in the top-half of the income distribution contribute 59 per cent of receipts.

Previous research by Leahy *et al*. (2011) highlighted that rural households face a slightly higher relative burden from VAT due to higher expenditure on fuel, light and transport. The EVE model also confirms this finding, with rural households spending €90.2 per week (7.3 per cent of income) in VAT, compared to €85.8 per week (6.7 per cent of income) for urban households. Non-carbon excises also tend to place a higher burden on rural households; rural households spend on average

Figure 4: Incidence of Indirect Taxes by Household Expenditure Decile



A. As a % of household income

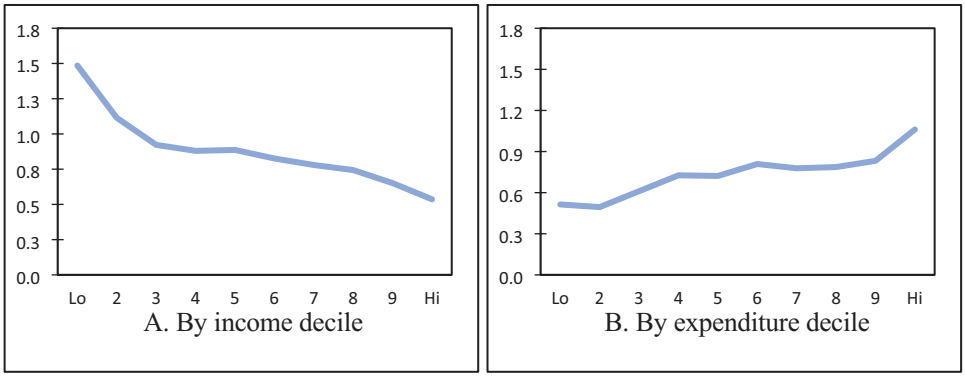
B. As a % of household expenditure

C. € per week

Source: Author's analysis using the EVE model and the HBS 2022/2023.

Notes: Households are sorted into expenditure deciles based on equivalised expenditure using the Irish national equivalence scale. The results are also presented in tabular format in Table A.3.

Figure 5: Mean Expenditure-to-Income Ratios of Households



Source: Author's analysis using the EVE model and the HBS 2022/2023.
Notes: Households are sorted into income/expenditure deciles based on equivalised disposable income/expenditure using the Irish national equivalence scale.

€33.8 (2.7 per cent of income) on such taxes while urban households spend €28.1 per week (2.2 per cent of income). Carbon taxes are also regressive relative to income and previous research has highlighted their disproportionate burden on rural households (Callan *et al*., 2009). Rural households spend an average of €6.5 per week on carbon taxes compared to an average spend of €4.0 per week for urban households. Low-income (bottom quintile) rural households are most negatively affected by carbon taxes (in relative terms) and spend €5.0 per week in carbon taxes – equivalent to 1.0 per cent of their household income. Overall, bottom quintile rural households spend 22.7 per cent of household income on indirect taxes, compared to 15.4 per cent for bottom quintile urban households. As before, a more neutral pattern emerges when comparison is made to expenditure, with bottom quintile rural households spending 16.4 per cent of their expenditure on indirect taxes compared to 12.2 per cent for top quintile rural households. This compares to 14.0 per cent for bottom quintile urban households and 10.7 per cent for top quintile urban households. Results for urban and rural households by income quintile are shown in Appendix Tables A.4 and A.5.

V DISCUSSION

In line with the literature, our estimates indicate that the Irish indirect tax system is regressive when compared to household income, with a more neutral pattern emerging when comparisons are made to household expenditure. The breadth of contribution to indirect taxes is noteworthy, with 41 per cent of modelled revenues generated from households in the bottom half of the income distribution. As such, indirect taxes facilitate broad-based contributions to society and offer the Exchequer a broad revenue source.

Recommendations by the Commission on Taxation and Welfare (2022) include widening the VAT base and limiting the use of zero and reduced rates of VAT alongside progressively increasing the reduced rate of VAT of 13.5 per cent over time. These suggestions would naturally increase effective tax rates on consumption. Based on our analysis, indirect taxes are charged at 12.6 per cent of household spending on average, with a rate of 13.8 per cent applying to the lowest income decile of households and 10.8 per cent applying to the highest income decile of households. Before implementing any reforms, we recommend policymakers consider whether they believe these rates to be too low, too high or reasonably fair. If policymakers wish to make alterations to the tax burden caused by indirect taxes, numerous policy levers can be availed of, e.g. changes to VAT rates/categories, alteration to existing excises and/or introduction of new excises.

How real incomes evolve over time is also a relevant metric to monitor in assessing the burden of indirect taxes on households. In a thought experiment with real consumption per capita and population fixed, VAT receipts will grow in line with inflation while excise receipts will stay constant. If real incomes are rising, indirect tax receipts as a share of household income will therefore fall. As such, real income growth, provided this is balanced throughout society, will reduce indirect tax liabilities as a share of household income. As such, when the economy is expanding, and real incomes rising, there is scope for policymakers to increase indirect tax rates and leave the incidence relative to household income unchanged. Equally, making no change to indirect taxes in this scenario will also reduce the ratio of indirect taxes to household income.

Overall, our analysis highlights that indirect taxes offer a broad-based source of revenue for the Exchequer, with low, middle and high-income households contributing to these taxes. This broad base is then necessarily linked to regressive tax burdens, which we have shown are particularly stark for low-income households. In making prospective reforms, we suggest that policymakers reflect on the effective tax rates indirect taxes levy on households consumption at present. Once this baseline is assessed, policymakers may alter the tax schedule to tax consumption at a desired level.

VI CONCLUSION

The Irish indirect tax system is complex, with households subject to (inter alia) taxes on consumption from a non-uniform value added tax, non-carbon based excises on mineral oils, alcohol and tobacco, alongside a carbon tax. Given this complexity, policymakers need analytical tools to analyse prospective changes to the tax system. Tax changes involve value judgements and inevitable lobbying around certain options is unlikely to give a neutral evaluation. As such, objective analysis using models is a key element of policy formulation.

In this paper, we have documented the EVE model and shown that the model replicates aggregate household liabilities to the set of modelled indirect taxes quite well. In discussing the equity of indirect taxation, the findings reinforce the existing literature, with indirect taxes being regressive relative to cross-sectional household income, with a more neutral pattern emerging relative to household expenditure.

Our findings indicate that household expenditure is taxed at an average rate of 12.6 per cent, with slightly higher rates for low-income households and slightly lower rates for high-income households. Given the regressive patterns in indirect taxes identified relative to household income, revenues from indirect taxes are generated broadly across the income distribution; 41 per cent from households in the bottom half of the income distribution compared to 59 per cent in the top half of the income distribution. As such, indirect tax revenues are generated broadly across society. Our suggestion to policymakers is to think fundamentally about indirect taxes. In particular, policymakers should consider what rate of tax on consumption they think best balances revenue-generating goals with distributional concerns, with 12.6 per cent being the average rate based on our analysis. Once this target tax rate is set, indirect tax reforms will have an underlying policy anchor against which to be assessed.

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APPENDIX

Table A.1: Excise Parameters Used in the EVE Model, 2023 Modelled Scenario

Tax Heading	*Tax Rate*
Alcohol Product Tax	
Spirits	€42.57 per litre of alcohol
Beer/Stout/Ale/Lager (>2.8% ABV)	€22.5 per hectolitre per cent alcohol of beer
Cider (>2.8% & <6% ABV)	€94.46 per hectolitre
Wine (Still, >5% & <15% ABV)	€424.84 per hectolitre of wine
Fortified Wine (Still, >15% ABV)	€616.45 per hectolitre of wine
Sparkling Wine (>5.5% ABV)	€849.68 per hectolitre of wine
Tobacco Product Tax	
Cigarettes	€403.32 per 1,000 cigarettes
+ Cigarettes (Ad Valorem)	Ad valorem charge of 8.73%
Cigars	€454.071 per kilogramme
Fine-cut tobacco	€436.842 per kilogramme
Mineral Oil Tax	
Petrol	€541.84 per 1,000 litres
Diesel	€425.72 per 1,000 litres
Home heating oil	€14.78 per 1,000 litres
Carbon Tax	
Petrol, Diesel, LPG, Natural Gas, Kerosene, Coal & Peat Briquettes	€48.50 per tonne of carbon

Source: Author's analysis using tax parameters set out by the Revenue Commissioners.

Table A.2: Modelled Weekly Mean Indirect Tax Liabilities by Household Income Decile

	VAT			*Non-carbon excises*			*Carbon Tax*			*Total Indirect Tax*		
Decile	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*
Lo	57.2	13.2	8.9	28.1	6.5	4.4	3.5	0.8	0.5	88.8	20.5	13.8
2	56.4	11.0	9.8	25.7	5.0	4.5	3.6	0.7	0.6	85.7	16.7	15.0
3	59.4	8.2	8.9	24.9	3.4	3.7	4.2	0.6	0.6	88.5	12.2	13.3
4	80.4	8.7	9.8	30.3	3.3	3.7	4.7	0.5	0.6	115.4	12.4	14.1
5	84.0	7.8	8.7	33.7	3.1	3.5	5.3	0.5	0.6	123.0	11.4	12.8
6	94.4	7.5	9.1	31.7	2.5	3.1	5.0	0.4	0.5	131.1	10.4	12.6
7	103.9	7.3	9.4	35.4	2.5	3.2	6.0	0.4	0.5	145.3	10.2	13.1
8	107.9	6.7	9.0	33.5	2.1	2.8	5.4	0.3	0.5	146.8	9.1	12.3
9	106.7	5.5	8.4	29.0	1.5	2.3	5.7	0.3	0.4	141.3	7.3	11.1
Hi	123.7	4.5	8.4	29.3	1.1	2.0	5.3	0.2	0.4	158.3	5.8	10.8
State	87.4	6.9	9.0	30.2	2.4	3.1	4.9	0.4	0.5	122.4	9.7	12.6

Source: Author's analysis using the EVE model and the HBS 2022/2023.
Notes: Household expenditure deciles are calculated using equivalised disposable income, with the Irish national equivalisation scale used. The table shows average indirect tax liabilities – VAT, non-carbon excises and the carbon tax – in € per week terms, as a share of household income and as a share of household expenditure.

Table A.3: Modelled Weekly Mean Indirect Tax Liabilities by Household Expenditure Decile

	VAT			*Non-carbon excises*			*Carbon Tax*			*Total Indirect Tax*		
Decile	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*
Lo	33.7	5.0	9.7	17.4	2.6	5.0	2.5	0.4	0.7	53.6	8.0	15.5
2	43.0	4.2	8.6	16.4	1.6	3.3	3.5	0.3	0.7	62.8	6.2	12.5
3	56.2	5.5	9.0	24.7	2.4	4.0	4.1	0.4	0.7	84.9	8.3	13.6
4	64.4	6.4	8.8	24.8	2.5	3.4	4.5	0.5	0.6	93.8	9.3	12.9
5	71.8	6.3	8.7	28.0	2.4	3.4	4.9	0.4	0.6	104.7	9.1	12.7
6	85.0	7.0	8.6	32.4	2.7	3.3	5.5	0.4	0.6	122.9	10.1	12.4
7	101.2	6.9	8.8	36.6	2.5	3.2	6.0	0.4	0.5	143.8	9.8	12.6
8	103.4	6.7	8.5	34.0	2.2	2.8	5.4	0.3	0.4	142.8	9.2	11.7
9	129.5	7.4	8.9	45.3	2.6	3.1	6.4	0.4	0.4	181.2	10.4	12.5
Hi	186.0	10.3	9.7	42.2	2.3	2.2	6.1	0.3	0.3	234.3	13.0	12.2
State	87.4	6.9	9.0	30.2	2.4	3.1	4.9	0.4	0.5	122.4	9.7	12.6

Source: Author's analysis using the EVE model and the HBS 2022/2023.
Notes: Household expenditure deciles are calculated using equivalised expenditure, with the Irish national equivalisation scale used. The table shows average indirect tax liabilities – VAT, non-carbon excises and the carbon tax – in € per week terms, as a share of household income and as a share of household expenditure.

Table A.4: Modelled Weekly Mean Indirect Tax Liabilities by Household Income Quintile, Urban Households

	VAT			*Non-carbon excises*			*Carbon Tax*			*Total Indirect Tax*		
Decile	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*
Lo	56.7	14.9	9.1	27.2	7.2	4.4	3.2	0.9	0.5	87.2	22.9	14.0
2	78.1	10.3	9.3	40.5	5.3	4.8	4.6	0.6	0.5	123.2	16.2	14.7
3	98.8	9.1	9.0	44.8	4.1	4.1	5.7	0.5	0.5	149.2	13.8	13.6
4	116.1	8.2	8.5	45.0	3.2	3.3	6.3	0.4	0.5	167.4	11.8	12.3
Hi	148.2	6.5	7.8	46.7	2.0	2.5	7.3	0.3	0.4	202.3	8.8	10.7
State	100.3	8.3	8.6	40.9	3.4	3.5	5.5	0.5	0.5	146.6	12.2	12.5

Source: Author's analysis using the EVE model and the HBS 2022/2023.
Notes: Household income quintiles are calculated using equivalised income, with the Irish national equivalisation scale used. Urban households are defined within the HBS data. The table shows average indirect tax liabilities – VAT, non-carbon excises and the carbon tax – in € per week terms, as a share of household income and as a share of household expenditure for urban households.

Table A.5: Modelled Weekly Mean Indirect Tax Liabilities by Household Income Quintile, Rural Households

	VAT			*Non-carbon excises*			*Carbon Tax*			*Total Indirect Tax*		
Decile	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*	*€ p.w.*	*Inc. (%)*	*Exp. (%)*
Lo	64.3	17.2	11.0	26.3	7.1	4.5	5.3	1.4	0.9	95.9	25.7	16.4
2	86.6	11.4	10.7	36.5	4.8	4.5	6.8	0.9	0.8	129.9	17.1	16.0
3	117.0	10.4	10.2	45.6	4.0	4.0	8.6	0.8	0.8	171.2	15.2	15.0
4	139.4	9.1	9.2	48.9	3.2	3.2	10.1	0.7	0.7	198.4	12.9	13.1
Hi	168.4	7.2	8.9	51.3	2.2	2.7	11.9	0.5	0.6	231.5	9.9	12.2
State	113.2	9.5	9.7	41.4	3.5	3.6	8.4	0.7	0.7	163.0	13.7	14.0

Source: Author's analysis using the EVE model and the HBS 2022/2023.
Notes: Household income quintiles are calculated using equivalised income, with the Irish national equivalisation scale used. Rural households are defined within the HBS data. The table shows average indirect tax liabilities – VAT, non-carbon excises and the carbon tax – in € per week terms, as a share of household income and as a share of household expenditure for rural households.